TRANSPLACENTAL (PASSIVE) TRANSMISSION OF PLAGUE ANTIBODIES IN RHOMBOMYS, SEROLOGICAL INVESTIGATION IN PLAGUE

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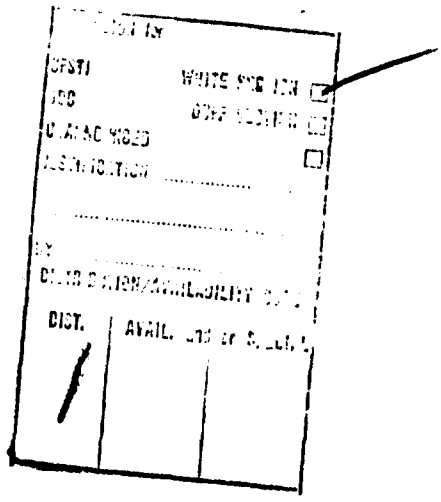

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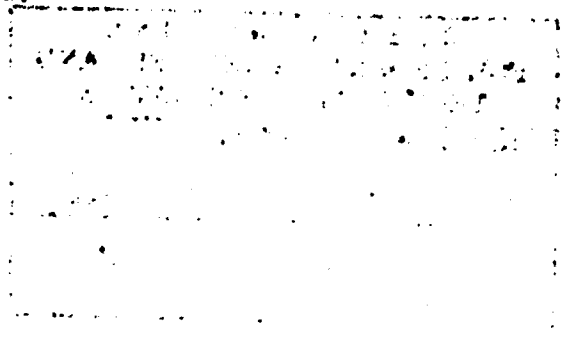

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TRANSPLACENTAL (PASSIVE) TRANSMISSION OF PLAGUE ANTIBODIES IN RHOMBOMYS, SEROLOGICAL INVESTIGATION IN PLAGUE

[Following is the translation of an article by M. I. Levi and Yu. G. Suchkov in the Russian-language journal Byulleten' Eksperimental'noy Biologii i Meditsini (Bulletin of Experimental Biology and Medicine), No 6, 1963, pages 88-91.]

From the Rostov-Na-Donu Scientific Research Antiplague Institute

(Received by editor 16 July 1962; presented by the Full Member of the Academy of Medical Sciences USSR N. N. Zhukov-Verezhnikov)

The facts of transmission of immunity or antibodies from immune females to progeny in mammals and birds in different bacterial and viral infections are well known. Even at the end of the last century Erlich established the transfer of antitoxins from immune females to their brood. He showed in fact that transfer of antibodies during milk feeding is possible in mice. A detailed survey of numerous studies undertaken abroad in this area during the twentieth century has been made by I. M. Mechnikov (5). In 1959 N. A. Demina published the survey "Transmission of Antibodies Through Eggs Deposited by Immune Birds". New studies concerned with passive transfer of antibodies to progeny in mammals and birds appear annually in the literature. Thus, very recently Coffin, Hook, and Muschel (6) showed that fetal blood in human beings possesses bacterial activity against staphylococci and streptococci, salmonella and intestinal bacillus. D. K. L'vov and R. L. Naumov (4) have found antibodies to tick-borne encephalitis virus in the progeny of fieldfare thrushes. The transmission of antibodies from immune females to the progeny has been recorded for chorea and influenza for all neuroviral infections, with the exception of lymphocytic choriomeningitis. In the last example, as Weigard and Hotchin (7) have shown, complement-fixating

antibodies are not transmitted from immune white mice to their progeny. However, studies concerned with the transmission of antibodies to the progeny in plague have not been found in the literature.

We decided to study the passive transference of antibodies to plague causative to the progeny of large jerboa. Experiments were performed on the large jerboas undergoing natural infection with plague and in the Central-Asiatic desert plague focus (Northern Priaral'ye).

Experimental Methods

Pregnant large jerboas were trapped during May 1962 in territory where plague epizootics were under way. Blood samples were taken under ether narcosis by a syringe from the heart. Some of the females were sacrificed immediately upon blood sampling and fetuses, placenta, and amniotic fluid of each embryo were removed separately. The fetuses were rinsed thrice with physiological saline solution, and then carefully ground in a mortar with sand and were reduced to pulp with physiological solution on a 1:10 basis, this suspension being used to dilute the fetal serum 1:20. The same procedure was followed with the placenta. The amniotic fluid was investigated for the presence of antibodies by the hemagglutination-inhibition reaction (20 observations), but antibodies were not found in any instance.

Some of the females following blood sampling were placed in 10-liter glass jars until time of birth. The jerboa were fed accustomed food (haloxylon, Russian thistle (salsole sp.), sage brush, meadow grass, and wild oats). During the first several days following birthing the females consumed their progeny (12 observations). In dark metallic cylinders only 2 females of 9 giving birth devoured their progeny.

The blood of newly born jerboa was studied on the day of birth, and on the 5th, 14th, 15th, and 20th day afterwards. On the day of birth blood could not be removed from the jerboa, necessitating dissection of the heart and liver and the preparation of washings of these organs in 2 ml of physiological saline solution. This infusion was placed in a test tube, left for 3-4 hours in room temperature, and then the upper layer of liquid removed, which was used to dilute the fetal serum 1:40. Blood was taken from the heart of jerboa aged 5 days and older through dissection of the thoracic cavity; the serum of young jerboa was always opalescent.

The suspension of fetus and placenta, the infusion /smyv/ of the heart and liver of the newly born jerboa and the amniotic fluid, the serum of the young and adult jerboas were heated for 30 minutes at 56 degrees, and studied in the hemagglutination-inhibition reaction (HI) together with formalinized erythrocytes, sensitized with fraction IA of plague positive agent. The method of the conduct of the reaction has been described in detail in Kratkoye Rukovodstvo po epizootologicheskomu obsledovaniyu...(Brief Manual on Epizootological Examination...) (edited by A. K. Shishkin, Rostov-na-Donu, 1960). The HI was carried out with all material from a single jerboa simultaneously.

Experimental Results

In all 51 pregnant females were caught, and antibodies to plague causative tested by hemagglutination-inhibition were found in 17 of the animals. At the same time only some of the animals could be investigated for the presence of antibodies in the amniotic fluid and placenta, while the embryos of all jerboas were investigated.

Thus, of 17 pregnant females containing antibodies in their blood 104 embryos, 44 placenta, and 42 specimens of amniotic fluid were obtained, for which in all cases (with the exception of 6 samples of amniotic fluid from a single jerboa) antibodies to plague causative were found. In most cases a definite correlation was observed in the antibody level in the female and embryos, placenta and amniotic fluid. In distinction to dilutions of the female serum, dilutions of the embryonic and placental suspension only approximately reflected the antibody titre in serum of the fetal blood, which is accounted for by characteristics of the methods used in preparing the suspensions. Noteworthy is the fact that the antibody titers in various embryos, placenta, or amniotic fluids obtained from a single female ranged within small limits.

In the HI-reaction investigation of 60 embryos, 27 placenta, and 23 amniotic fluids taken from females not containing antibodies in their blood, a negative result was forthcoming.

Since the large jerboas born in captivity ate their own offspring, we were not able to trace the duration of antibody carrier status of the newly born jerboas for a large sample, although in somecases this was possible. In all 42 animals were investigated.

It is easy to note that in all cases antibodies were found during the periods investigated in the progeny, in which as a rule a correlation was observed between the antibodies

TABLE 1

Distribution of Antibodies in Pregnant Females, Embryos in Placenta and Amniotic Fluid

a) Номер животного	b) Исследуемая жидкость							
	c) кровь беременной самки	d) суспензии из тканей эмбрионов			e) суспензии из тканей плацент		f) околоплодная жидкость	
	g) титр	h) количество исследованных в РТГА эмбрионов	i) средний размер плода (в см)	g) титр	j) количество плацент	g) титр	k) количество образцов околоплодной жидкости	g) титр
1	5 120	7		640—1 280	7	320—640	5	16—32
2	1 280	4		320—640	4	160—320	4	32—128
3	320	6		320—640	6	20—80	6	<16
4	1 280	6		320—1 280			3	64—128
5	20 480	5		5 120—20 480	5	5 120—10 240	2	2 560—5 120
6	320	3		80—160	3	80—160	3	32—64
7	2 560	5		320—640	5	640	5	128—256
8	320	4	2,5	160—320	4	160—320	4	128
9	5 120	10	1	640—1 280				
10	163 840	9	1	2 560—5 120				
11	5 120	8	2,5	1 280—2 560				
12	10 240	8	2	1 280—2 560				
13	1 280	4		320—640				
14	2 560	9	1	320—640				
15	640	6	2	160—320	6	160—320	6	64—128
16	2 560	6	1,5	1 280—2 560				
17	2 560	4	2	1 280	4	320—640	4	128—256
18—31	0	60	1—2	0	27	0	23	0
l) Всего . . .		164			71		65	

Remark. We denote by the antibody titer the value which is the reciprocal of the limiting dilution of the serum active in the HI test.

LEGEND: a) number of animal; b) fluid investigated; c) blood of pregnant female; d) suspension of embryonic tissues; e) suspension of placental tissues; f) amniotic fluid; g) titer; h) number of embryos tested in the HI reaction; i) average size of fetus (in cm); j) number of placenta; k) number of samples of amniotic fluid; l) total

titer in pregnant females and their offspring. We must not forget that the method of investigating newly born jerboa precludes precise estimates of the number of antibodies in the serum of the animal. Within the limits of 20 days still higher antibody titers were observed.

TABLE 2

Determination of Antibodies in Sera of Pregnant Females and their Progeny

a Номер животного	b Сроки определения до родов (в днях)	c Титр антител				
		d в сыворотке беременной самки	e в сыворотке детенышей			
			f в день рождения	g через 5 дней	h через 14—15 дней	i через 20 дней
1	12	20 480	1 280, 640[1]			
2	7	2 560	1 280, 1 280		1 280	640, 640
3	21	320	320, 160			
4	5	10 240	2 560, 1 280	1 280		1 280
5	5	2 560	640, 640	640		160
6	8	640	640, 320	160	160	160, 160
7	3	5 120	1 280, 640			
8	3	160	320, 160			
9	8	5 120	640, 640	320, 640	80, 80	
j Итого. . .		9	18	5	4	6

[1] Two figures in the column mean that two jerboas were investigated during the time indicated.

LEGEND: a) number of animals; b) period of determination before birth (in days); c) antibody titer; d) in serum of pregnant females; e) in serum of young; f) on day of birth; g) five days afterwards; h) in 14-15 days after birth; i) in 20 days; j) total

The data leaves no doubt that under natural conditions antibodies are transferred from immune females of large jerboas to their progeny. It remains unclear how long is the residence of passively transferred antibodies in large jerboas and whether the antibodies play a protective role. It has been noted in the literature that in many infections the period during which antibodies can be detected in progeny averages 2-4 weeks. It is doubtless true that the duration of detection

[illegible] the young depends on the original titer in the [illegible] progeny. It is precisely because of this that it w[illegible] to count not only the duration of antibody dete[illegible] but also the period of semibreakdown of the passively [illegible], which period does not depend on the [illegible]. Thus, in children born from mothers immune to [illegible], the period of semibreakdown of virus-neutralizing antibo[illegible] days (1). It did not appear possible with our [illegible] wer the question of the dynamics of break[illegible]nsmitted antibodies, although the impres[illegible] the 20th day the antibody titer decreased [illegible].

[illegible] role of antibodies in plague has been [illegible] several investigators (3). Although no data in favor [illegible] role of passively transmitted antibodies [illegible], we decided to put forth the following hypothesis. [illegible] jerboa in the Central Asiatic desert natural foci [illegible] principal hosts of plague causative microorganisms, which [illegible] to a considerable extent the relatively high res[illegible] adult animals to this infection. In all probab[illegible], as has also been established for noon [illegible] left bank of the Volga, plague resistance is [illegible] heredity from generation to generation. However, [illegible] are not born resistant, this quality in [illegible] by the time that feeding on maternal [illegible] the time of onset of sexual maturity. [illegible] resistance in locations where extense [illegible] been underway and where the probability [illegible] by a bite of a plague tick is high [illegible] the ticks feed more voraciously on the [illegible] jerboa), the organism of the young is under [illegible] maternal antibodies. We know that in [illegible] the percentage of adult jerboas containing [illegible] causative in their serum range from 20 to [illegible] ion of antibodies from immune females [illegible] the survival of the young of large jerboa [illegible] where extended plague epizootics are in [illegible].

LITERATURE

1. [illegible], Taranova, G. P., Voprosy virusologii ([illegible] Virology), 1961, No 6, page 700.
2. [illegible] Zhurnal mikrobiologii (Journal of Microbiology), [illegible], No 1, page 109.
3. [illegible] Zhemchuzhnikov, N. N., Immunologiya chumy (Immunology of Plague) Moscow-Leningrad, 1940.

4. L'vov, D. K. Naumov, R. L., Meditsinskaya parazitologiya (Medical Parasitology, 1962, No 3, page 335.
5. Mechnikov, I. I., Nevostriimchivost' v infektsionnykh boleznyakh (Nonsusceptibility and Infectious Diseases), Moscow, 1947.
6. Coffin, G. S., Hook, W. A., Muschel, L. H., Proc. Soc. exp. Biol. (N. Y), 1960, Vol. 104, page 239.
7. Weigand, H., Hotchin, J., Journal of Immunology, 1961, Vol. 86, page 401.